REMARKS

Further and favorable reconsideration is respectfully requested in view of the foregoing amendments and following remarks.

Claim 7 has been amended into independent form, and to make minor changes of an editorial nature. Additionally, claim 17 has been amended to depend from claim 7 and to incorporate the limitations of claim 2. Thus, no new matter has been added to the application.

The patentability of the present invention over the disclosures of the references relied upon by the Examiner in rejecting the claims will be apparent upon consideration of the following remarks.

The rejection of claims 7-12 and 17-27 under 35 U.S.C. § 103(a) as being unpatentable over Gao et al. in view of Boyer is respectfully traversed.

The Examiner takes the position that Gao et al. disclose a process comprising mixing gallium oxide powder and carbon powder into a uniform state, subjecting the powder to heating treatment at 1360°C under inert gas flow, thus vaporizing the mixture, and causing the vapor to react at a temperature of 800°C, wherein a vertical high frequency induction heating furnace is used to conduct the heating treatment.

The Examiner admits that Gao et al. do not disclose the use of indium oxide powder.

The Examiner asserts that Boyer disclose a temperature responsive device, which uses gallium or indium alone or in combination with other metals as temperature sensing materials. The Examiner takes the position that it would have been obvious to one of ordinary skill in the art at the time the invention was made to use indium instead of gallium, as taught by Boyer, when making the oxide for the temperature sensitive composition disclosed by Gao et al., because Boyer teaches that the metals are equivalent.

The Examiner further admits that Gao et al. fail to teach that the heating treatment is conducted for one hour or more. The Examiner takes the position that this limitation, absent any criticality, is considered to be the optimum amount of time for conducting the heating treatment used by Gao et al.

In the nanothermometer of Gao et al., one end of the carbon nanotube is opened. Accordingly, the gallium in the carbon nanotube is easily oxidized in use or under storage. The formed gallium oxide is in a solid state at elevated temperature, and does not exhibit flowability. When the temperature changes, remarkable expansion or contraction cannot be obtained. Thus, it is difficult for the carbon nanotube containing the gallium oxide therein to operate as the thermometer as it is.

However, based on the teachings of Gao et al., one of ordinary skill in the art would not look to another metal for the nanothermometer. In fact, Gao et al. state "[w]e chose gallium as our thermal indicator because it has one of the greatest liquid ranges of any metal (29.78-2,403°C) and a low vapour pressure even at high temperatures. Based on this disclosure, one of ordinary skill in the art would not substitute another metal for gallium in the teachings of Gao et al.

Further, the Boyer reference is a very dated reference (filed November 1925), and thus the information contained therein was readily available to Gao et al. at the time of their article. However, Gao et al. still chose to employ gallium rather than indium, thus further distinguishing from Applicants' invention.

As described in Boyer, gallium exhibits the tendency to adhere to the glass surface of a thermometer, i.e., to lose the flowability. (See page 1, lines 61-68 of Boyer.) This tendency of gallium is due partly to the formation of an oxide of gallium, as gallium is a very easily oxidizable metal. For this reason, Boyer produces a thermometer containing gallium therein by repeating the heating to remove the oxide and the impurities and by sealing the tube finally so as not to enter air therein.

Indium has melting point of about 156°C, and is in solid state at room temperature. On the other hand, gallium has melting point of about 30°C. As stated on page 7 of Applicants' specification, the reason indium was chosen was because it has a relatively low melting point and a high boiling point of 2050°C, where the temperature range of the liquid phase thereof is high so that the vapor pressure thereof is low even at high temperatures. Thus, indium is suitable for being used for a wide temperature range.

The Examiner's reasoning for combining the cited references is because the Examiner asserts that Boyer teaches equivalence between indium and gallium. However, as stated above, indium was chosen due to its particular characteristics. Further, the

Boyer reference itself points out distinctions between the two metals. (See page 1, lines 44-60 of Boyer.)

The temperature sensitive element of Applicants' invention is comprised of a carbon nanotube whose one end is open and which contains continuous and columnar indium. Since the temperature sensitive element of Applicants' invention is hard to oxidize under storage at room temperature, it does not lose flowability in use or under storage at room temperature. On the contrary, the thermometer of Boyer does not use a carbon nanotube, and has a very large scale in comparison with the temperature sensitive element of Applicants' invention, (or the teachings of Gao et al.). The skilled person would not combine the nanothermometer of Gao et al. with Boyer's thermometer. In addition, it is necessary for Boyer's thermometer to prevent the oxidization, and the process for manufacturing the same is very complicated.

For these reasons, the invention of claims 7-12 and 17-27 is clearly patentable over Gao et al. in view of Boyer.

Therefore, in view of the foregoing amendments and remarks, it is submitted that the ground of rejection set forth by the Examiner has been overcome, and that the application is in condition for allowance. Such allowance is solicited.

If, after reviewing this Amendment, the Examiner feels there are any issues remaining which must be resolved before the application can be passed to issue, the Examiner is respectfully requested to contact the undersigned by telephone in order to resolve such issues.

Respectfully submitted,

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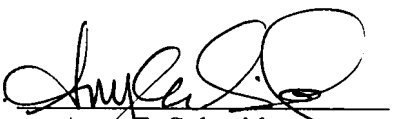
By 

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